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Zhao

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(54) **ELECTRICAL CONNECTOR HAVING GROUND AND POWER CONTACTS EACH WITH PLURAL TAIL PORTIONS**

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H01R 43/24	(2006.01)
H01R 13/504	(2006.01)
H01R 13/6594	(2011.01)
H01R 24/60	(2011.01)

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CPC ***H01R 13/6597*** (2013.01); ***H01R 13/504*** (2013.01); ***H01R 13/6471*** (2013.01); ***H01R 13/6594*** (2013.01); ***H01R 43/24*** (2013.01); *H01R 24/60* (2013.01)

(58) **Field of Classification Search**

CPC H01R 13/6597; H01R 13/6594; H01R 43/24; H01R 13/6471; H01R 13/504; H01R 13/6477; H01R 13/658; H01R 13/6581; H01R 12/721

USPC 439/607.01

See application file for complete search history.

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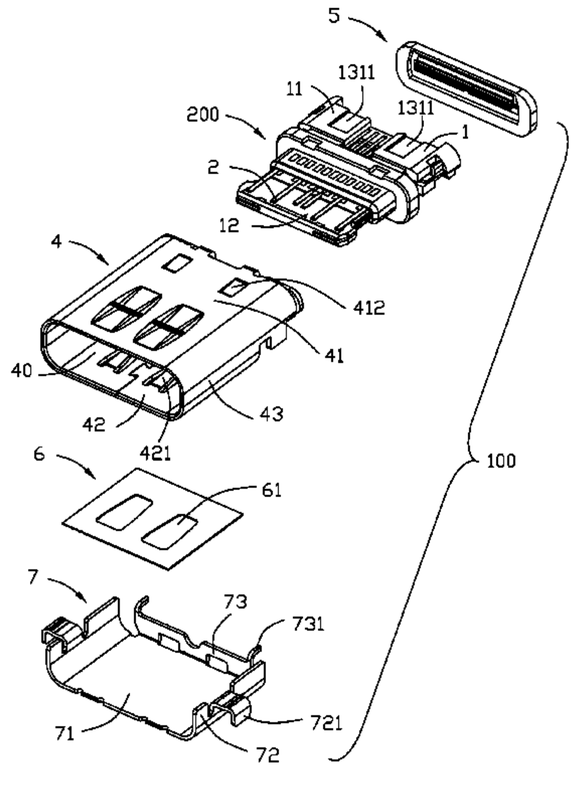
(57) **ABSTRACT**

An electrical connector includes: an insulative housing having a base and a tongue; two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue, each row of contacts including an outermost ground contact and an adjacent power contact next to the ground contact; and a shielding shell enclosing the insulative housing, wherein each of the ground contact and the power contact in at least one of the two rows has a contacting portion, plural tail portions, and an intermediate portion between the contacting portion and the plural tail portions.

5 Claims, 9 Drawing Sheets



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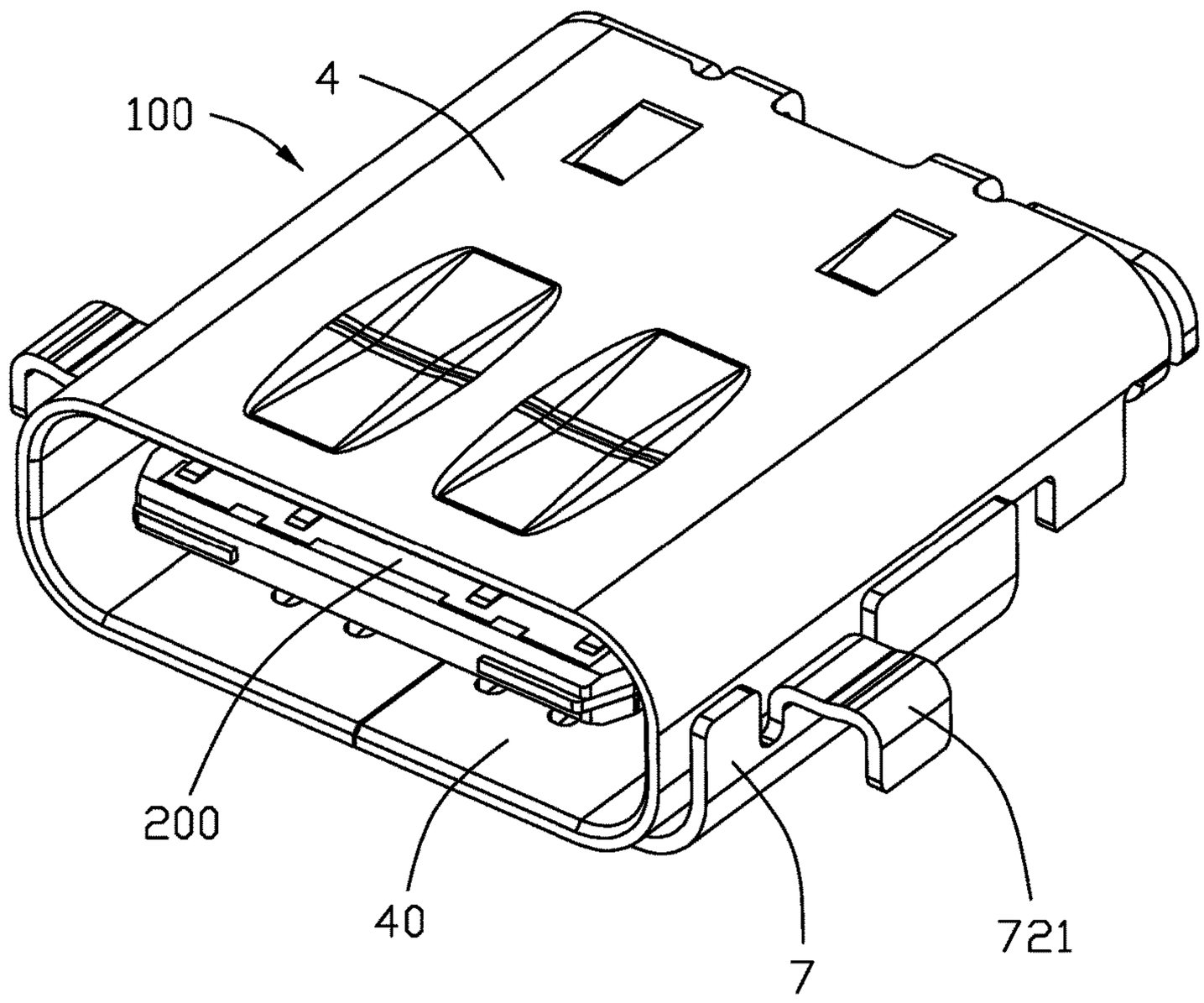


FIG. 1

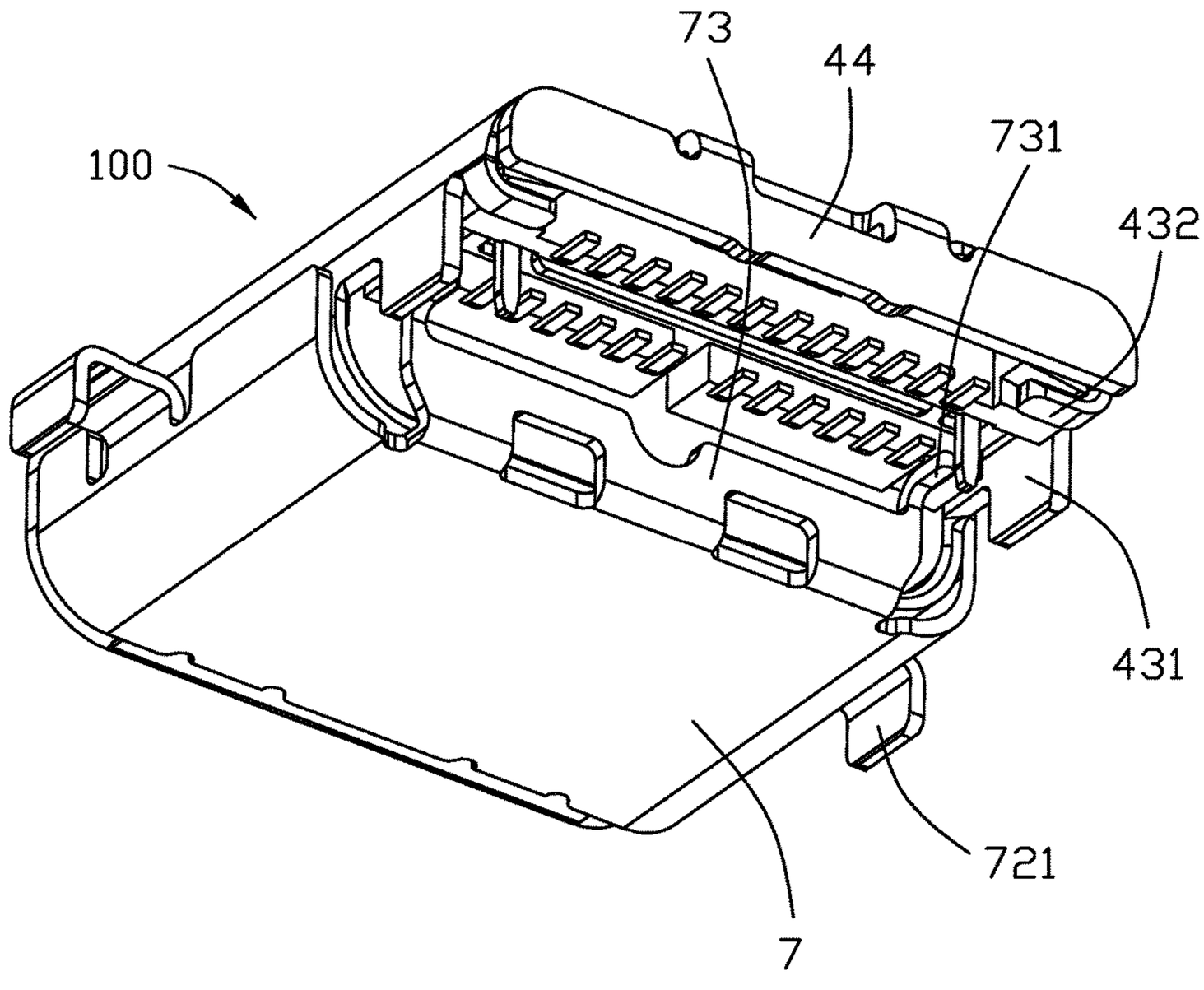
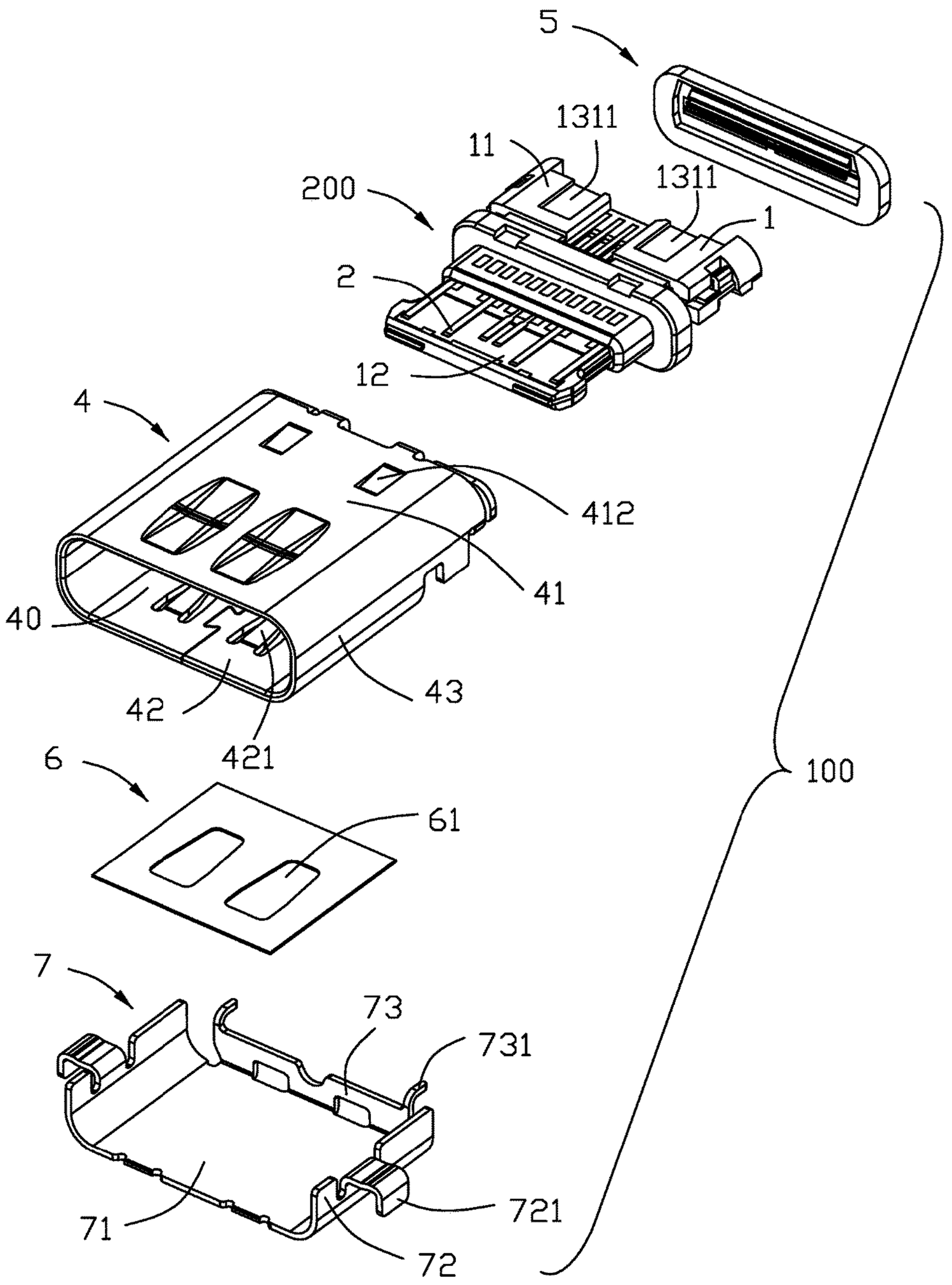


FIG. 2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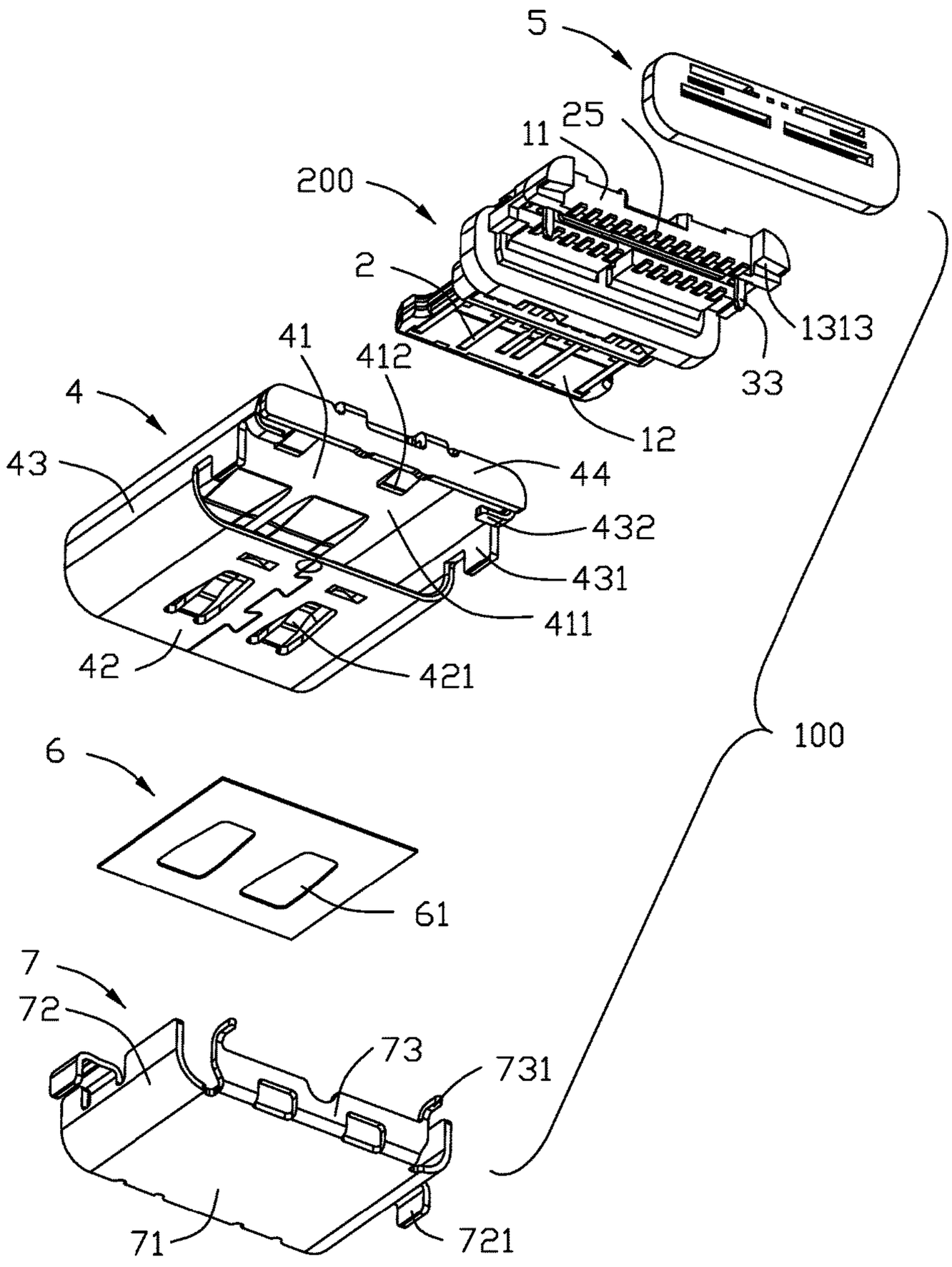
1311
11
1311
200
1
2
12
4
412
41
40
43
42
421
6
61
100
7
73
731
71
721
72

FIG. 3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25
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1313
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41
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71
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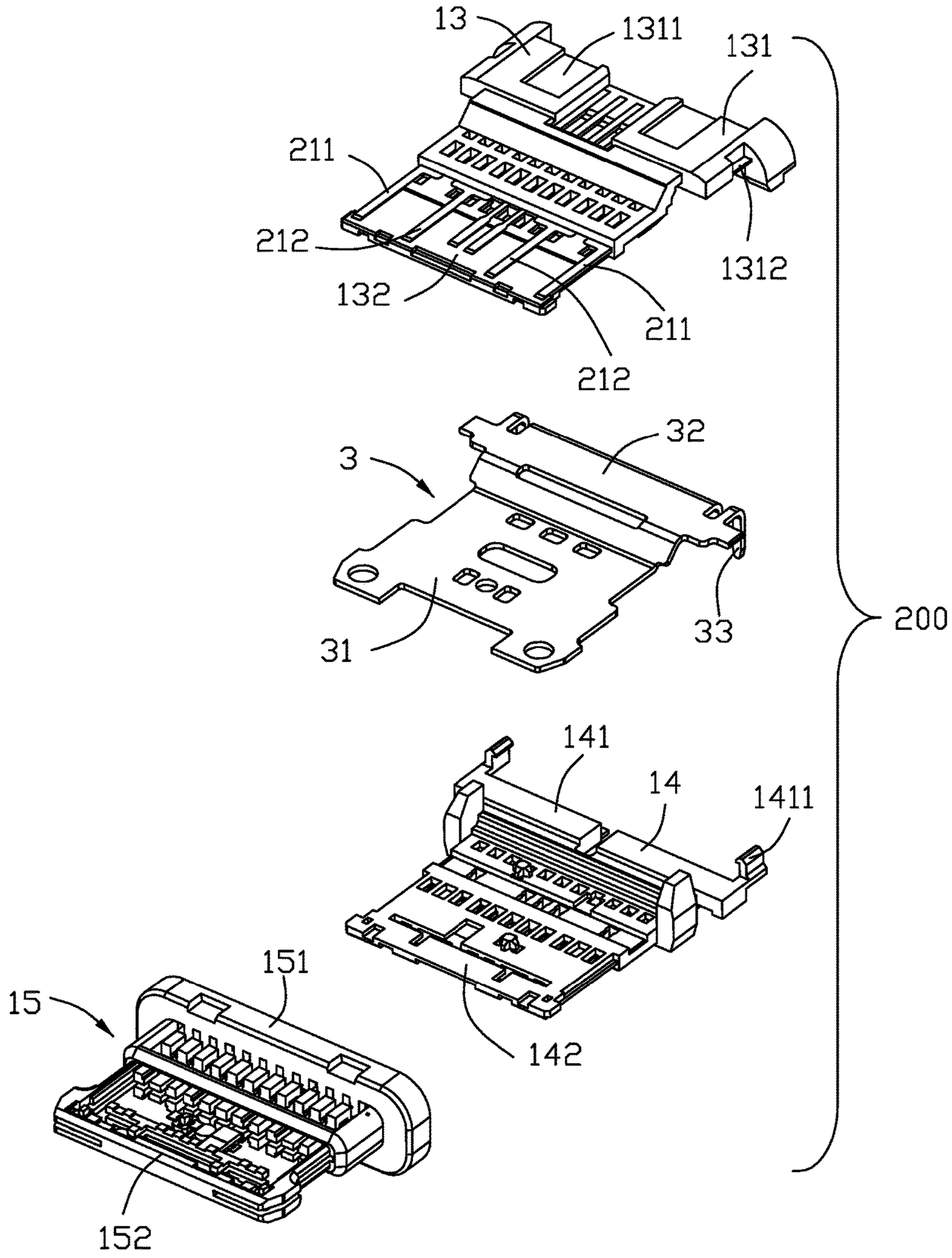
FIG. 4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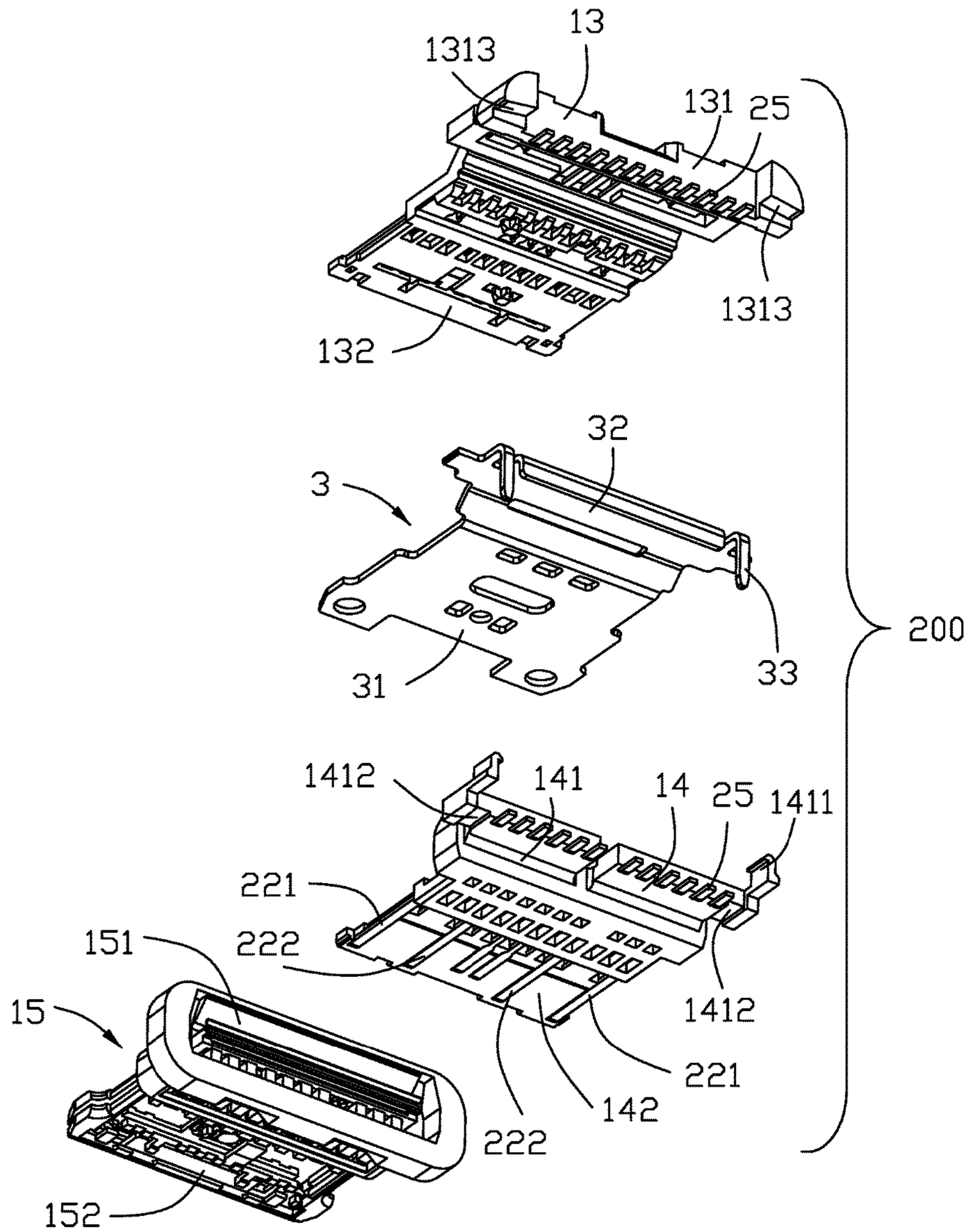
1311
131
211
212
1312
132
211
212
200
32
3
31
33
141
14
1411
151
15
142
152

FIG. 5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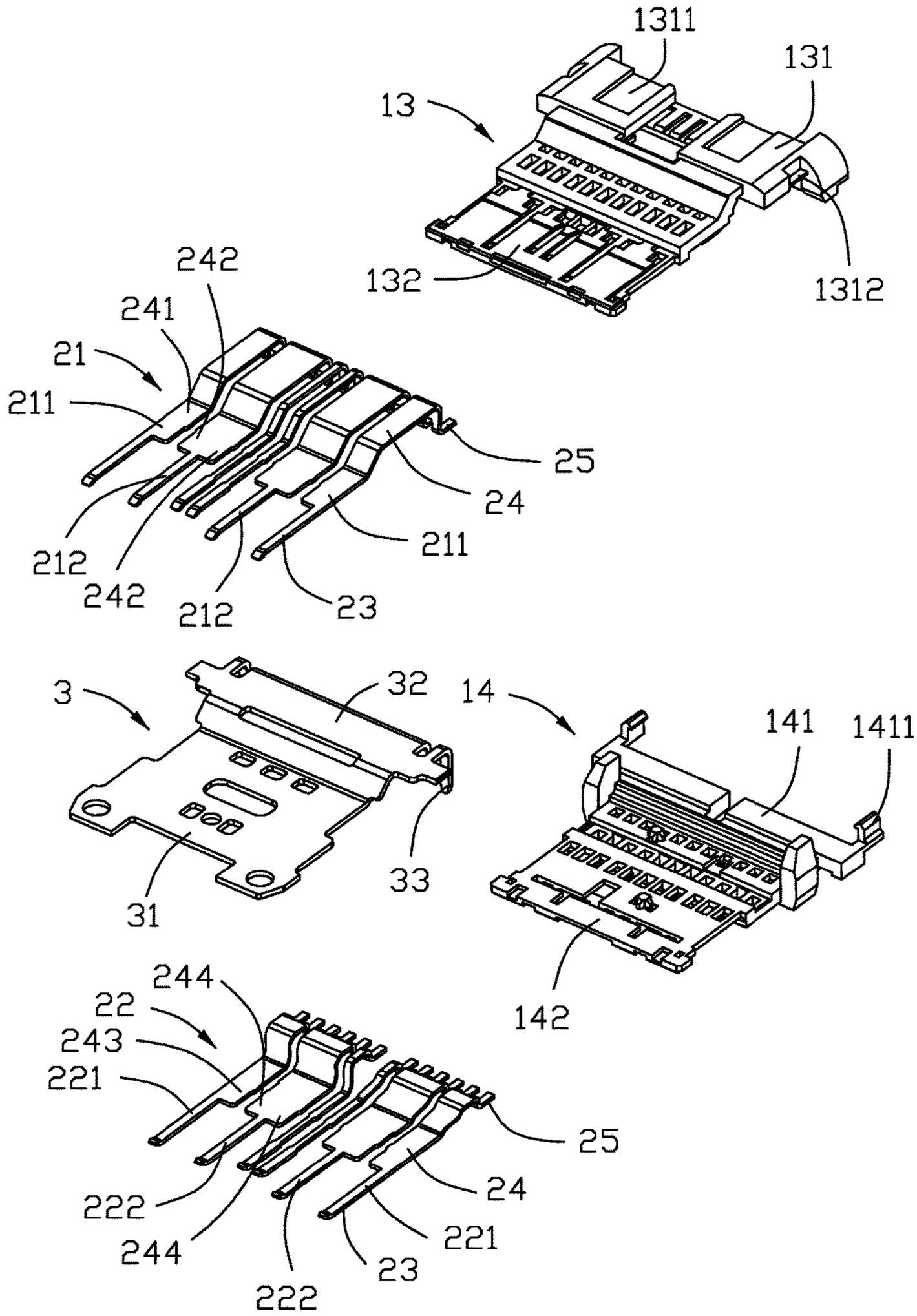
1412
15
221
142
222
152

FIG. 6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131
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132
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21
211
25
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211
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242
212
23
3
32
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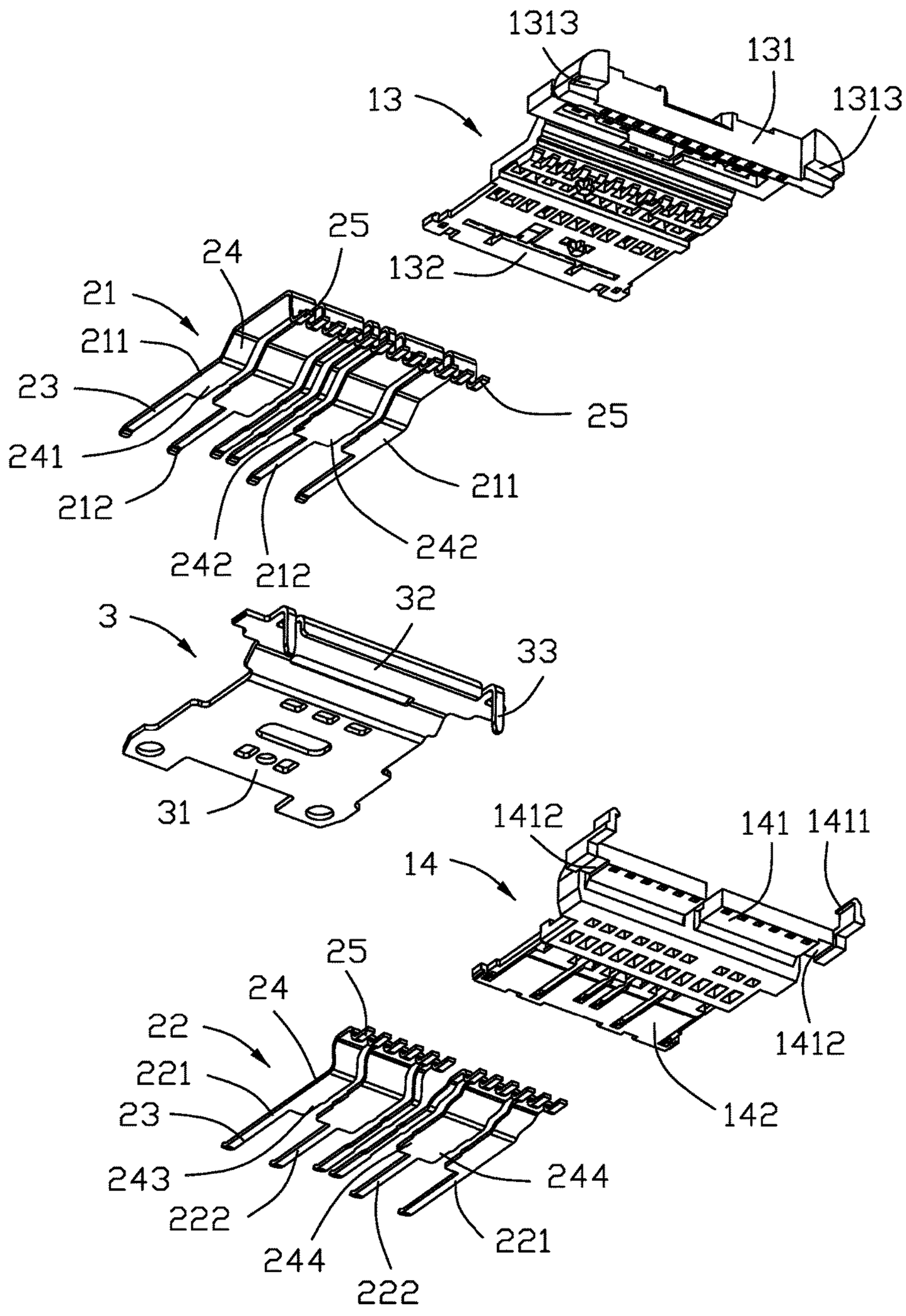
141
1411
31
33
142
244
22
243
221
25
24
222
244
221
23
222

FIG. 7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3
33
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1412
141
1411
14
25
24
1412
22
221
142
23
243
244
222
244
221
222

FIG. 8

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
GND			Vbus		D+	D−		Vbus			GND
GND			Vbus		D−	D+		Vbus			GND
B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1

FIG. 9

ELECTRICAL CONNECTOR HAVING GROUND AND POWER CONTACTS EACH WITH PLURAL TAIL PORTIONS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electrical connector having two rows of contacts including wide ground and power contacts to conduct large current, wherein each of the ground contact and the power contact has plural tail portions for current flow and heat dissipation consideration.

2. Description of Related Arts

U.S. Patent Application Publication No. 2017/0018883 discloses a dual orientation connector, e.g., a Universal Serial Bus (USB) Type-C connector, where a rightmost or leftmost ground terminal (Gnd) or a first supplemental terminal (SUB1) can be omitted. Furthermore, the ground terminal (Gnd) may be replaced by a power terminal (Power/VBUS) where a width of the power terminal (Power/VBUS) may be equal to a width of a first signal contact, or greater than the width of the first signal contact for large current transmission.

U.S. Pat. No. 8,376,785 describes a conventional USB3.0 connector having a first group of terminals and a second group of terminals where a ground terminal in the first group is depicted to have two tail portions.

SUMMARY OF THE INVENTION

An electrical connector comprises: an insulative housing having a base and a tongue; two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue, each row of contacts including an outermost ground contact and an adjacent power contact next to the ground contact; and a shielding shell enclosing the insulative housing, wherein each of the ground contact and the power contact in at least one of the two rows has a contacting portion, plural tail portions, and an intermediate portion between the contacting portion and the plural tail portions.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a front perspective view of an electrical connector in accordance with the present invention;

FIG. **2** is a rear perspective view of the electrical connector;

FIG. **3** is an exploded view of the electrical connector;

FIG. **4** is another exploded view of the electrical connector;

FIG. **5** is a front exploded view of a contact module of the electrical connector;

FIG. **6** is a rear exploded view of the contact module;

FIG. **7** is a further exploded view of the contact module in FIG. **5** omitting an over-mold thereof;

FIG. **8** is a rear view of the contact module in FIG. **7**; and

FIG. **9** is a schematic table showing contact arrangement of the electrical connector.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1-9**, an electrical connector **100** comprises a contact module **200** and a shielding shell **4** enclosing the contact module **200**. The electrical connector **100** may further comprise a rear sealing element **5**, a water-proof film **6**, and an auxiliary shell **7**.

Referring specifically to FIGS. **3-9**, the contact module **200** includes an insulative housing **1**, two rows of contacts **2** arranged in the insulative housing **1**, and a shielding plate **3** arranged in the insulative housing **1** between the two rows of contacts **2**.

The insulative housing **1** includes a base **11** and a tongue **12**. The insulative housing **1** is constructed of an upper insulator **13** that is insert molded with an upper row of contacts **21**, a lower insulator **14** that is insert molded with a lower row of contacts **22**, and an over-mold **15**. The upper insulator **13** has a base part **131** and a tongue part **132**. The base part **131** has a pair of recesses **1311**, a pair of latches **1312**, and a pair of engaging faces **1313**. The lower insulator **14** has a base part **141** and a tongue part **142**. The base part **141** has a pair of hooks **1411** and a pair of grooves **1412**. The over-mold **15** a base part **151** and a tongue part **152**. The base parts **131**, **141**, **151** constitutes the base **11** of the insulative housing **1**. The tongue parts **132**, **142**, **152** constitute the tongue **12** of the insulative housing **1**.

Referring specifically to FIGS. **7-9**, as is well known in this art, the upper row of contacts **21** and the lower row of contacts **22** are reversely-symmetrically arranged and each contact **2** has a contacting portion **23**, a tail portion **25**, and an intermediate portion **24** between the contacting portion and the tail portion.

As shown in FIG. **9**, the upper row of contacts **21** include a pair of ground contacts **211** at positions A**1** and A**12**, a pair of power contacts **212** at positions A**4** and A**9**, and a pair of signal contacts at positions A**6** and A**7**. Positions A**2**-A**3**, A**5**, A**8**, and A**10**-A**11** are vacant. Similarly, the lower row of contacts **22** include a pair of ground contacts **221** at positions B**1** and B**12**, a pair of power contacts **222** at positions B**4** and B**9**, and a pair of signal contacts at positions B**6** and B**7**. Positions B**2**-B**3**, B**5**, B**8**, and B**10**-B**11** are vacant.

In the upper row of contacts **21**, for the pair of ground contacts **211** at positions A**1** and A**12**, corresponding intermediate portion **24** has a respective widened section **241** to also occupy neighboring position A**2** or A**11**. Moreover, each ground contact **211** has two tail portions **25**. For the pair of power contacts **212** at positions A**4** and A**9**, corresponding intermediate portion of the power contact at position A**4** has two widened sections **242** to also occupy neighboring positions A**3** and A**5** and corresponding intermediate portion of the power contact at position A**9** has two widened sections **242** to also occupy neighboring positions A**8** and A**10**. Moreover, each power contact **212** has three tail portions **25**. The additional tail portions all extend from the widened sections.

The ground and power contacts in the lower row of contacts **22** are similarly designed to have widened sections **243** and **244**. Moreover, the plural tail portions **25** of the ground contacts **211** and the power contacts **212** in the upper row are arranged in one line and the plural tail portions **25** of the ground contacts **211** and the power contacts **212** in the lower row are arranged in another line.

The contacting portion **23** of each contact is not widened so that a width of the contacting portion **23** of the ground contact **211** or the power contact **212** is equal to a width of the contacting portion **23** of the signal contact. Without widening the contacting portion avoids potential short circuiting of the widened power contacts. Besides current flow and heat dissipation, the plural tail portions also strengthen soldering to a printed circuit board to which the electrical connector **100** is mounted.

The shielding plate **3** has a main part **31**, a supporting part **32**, and a pair of soldering legs **33**.

Referring to FIGS. **3-4**, the shielding shell **4** has a top wall **41**, a bottom wall **42**, and a pair of side walls **43** surrounding a receiving space **40**. The top wall **41** has a rear extension **44**. The shielding shell **4** includes an opening **411**. The top wall further has a pair of fixing tabs **412**. The side walls **43** has a pair of positioning legs **431** and a pair of engaging tabs **432**. The bottom wall **42** has a pair of spring tangs **421**.

The water-proof film **6** has a pair of holes **61**.

The auxiliary shell **7** has a main part **71**, a pair of side walls **72**, and a rear wall **73**. Each side wall **72** has a leg **721**. The rear wall **73** has a pair of clamps **731**.

The electrical connector **100** is generally manufactured in processing steps well known in this art.

From a technical viewpoint, the subject connector **100** owns the configuration essentially compatible with the contour of the Type C connector including the contact tails in a full amount, i.e., the twelve tail portions in each row, while removing the contacting portions of the unused contacts, and further unifying the corresponding intermediate portions of those unused contacts with those of the operating/useful contacts for not only enhancing the structures thereof but also delivering much power or increasing grounding effect. As mentioned before, there are twelve positions for the contacts in each row. Notably, the arrangement of the invention is essentially in a symmetrical manner with regard to a front-to-back centerline of the tongue in the transverse direction thereof wherein the intermediate portion of the outermost ground contact owns essentially two positions, the intermediate portion of the innermost signal contact owns essentially only one position, while the intermediate portion of the middle power contact owns essentially three positions. Understandably, the whole space on the tongue is fully used in a symmetrical and systematical way based upon the standard full pin Type C connector, compared with the traditional large power delivery connector having the enlarged/widened intermediate portion thereof in an odd manner. It is also noted that in the embodiment the intermediate portion of the middle power contact has barbs on two sides while that of the outermost ground contact has barbs only on the inner side. It is also noted that the contact portion is symmetrical with regard to the intermediate portion along the transverse direction in the corresponding power contact and the signal contact while is asymmetrical with regard to that in the corresponding ground contact.

What is claimed is:

1. An electrical connector comprising:

an insulative housing having a base and a tongue;

two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue, each row of contacts including an outermost ground contact and an adjacent power contact next to the ground contact; and

a shielding shell enclosing the insulative housing, wherein each of the ground contact and the power contact in at least one of the two rows has a contacting portion, plural tail portions, and an intermediate portion between the contacting portion and the plural tail portions; wherein the ground contact has two tail portions and the power contact has three tail portions; wherein each row of contacts comprise a pair of outermost ground contacts and a pair of adjacent power contacts next to the pair of ground contacts, and the ground contacts and the power contacts in one row each have plural tail portions arranged in one line and the ground contacts and the power contacts in the other row each have plural tail portions arranged in another line.

2. The electrical connector as claimed in claim **1**, wherein a width of the intermediate portion of each ground contact is greater than a width of the contacting portion thereof, and a width of the intermediate portion of each power contact is greater than a width of the contacting portion thereof.

3. The electrical connector as claimed in claim **1**, wherein a width of the tail portion of each ground contact is equal to a width of the contacting portion thereof, and a width of the tail portion of each power contact is equal to a width of the contacting portion thereof.

4. An electrical connector comprising:

an insulative housing having a base and a tongue defining twelve positions in a transverse direction;

two rows of contacts arranged in the insulative housing and exposed respectively to two opposite surfaces of the tongue in a vertical direction position to said transverse direction, in each row said contacts arranged in a symmetrical manner with regard to a front-to-back extending centerline of the tongue portion in said transverse direction and including a pair of outermost ground contacts, a pair of innermost signal contacts and a pair of power contacts therebetween; and

each of said contacts having a front contact portion, a rear tail portion and an intermediate portion therebetween in a front-to-back direction perpendicular to said transverse direction and said vertical direction; wherein

the intermediate portion of the outermost ground contact occupies two positions, the intermediate portion of the innermost signal contact occupies one position while the intermediate portion of the power contact occupies three positions; wherein there are twelve tail portions in each row corresponding to said twelve positions; wherein the contact portion is essentially symmetrical with regard to the corresponding intermediate portion in both the power contact and the signal contact in the transverse direction while is symmetrical in the ground contact.

5. The electrical connector as claimed in claim **4**, wherein barbs are formed on two sides of the intermediate portion of the power contact while on only an inner side of the intermediate portion of the outermost ground contact.

* * * * *